

STRTS

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TOOTHBRUSH

TECHNICAL FIELD

5       The present invention relates to a toothbrush.

BACKGROUND ART

10       The cause of tooth decay has been considered as a result of that food dregs or the like remain as plaques on the surface of teeth with interposition of Streptococcus strain such as Streptococcus mutans, sugar components in the plaque are converted into acids by Streptococcus mutans, Lactobacillus strain and Candida strain, and the acid dissolves calcium components in the tooth. This is the reason  
15 why tooth polishing is promoted as prevention of tooth decay.

      However, conventionally used toothbrushes cannot suppress the activity of the bacteria and fungi as described above, although they are effective for at least removing the plaques.

20       The present inventors have noticed, in relation to the problem as described above, that natural materials obtained from the nature, particularly products obtained by calcining and pulverizing natural porous materials abundant in calcium components such as shells that have been disposed of as useless wastes, have antibacterial and antifungal activities  
25 while they are harmless to human bodies. A problem of the invention, which takes the above-mentioned situations into consideration, is to provide a toothbrush that contains the product above and suppresses the activities of intraoral bacteria and fungi by the antibacterial and antifungal  
30 properties of the product. An object of the invention is to prevent tooth decay and to maintain sanitary conditions of the toothbrush used in the oral cavity.

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## DISCLOSURE OF INVENTION

The present invention has been achieved in view of the problems described above for solving the problems, and an object of the invention is to provide a toothbrush comprising  
5 at least one of bristles of a synthetic resin with which a product obtained by pulverizing shells having crystalline structural body of calcite type structure of calcium carbonate is mixed, or a handle of a synthetic resin with which a product obtained by pulverizing shells having crystalline  
10 structural body of calcite type structure of calcium carbonate is mixed.

Another object of the invention is to provide a toothbrush comprising at least one of bristles coated with a coating material containing a product obtained by pulverizing  
15 shells having crystalline structural body of calcite type structure of calcium carbonate, or a handle coated with a coating material containing a product obtained by pulverizing shells having crystalline structural body of calcite type structure of calcium carbonate, so as to solve the above  
20 problems.

Preferably, according to the invention, the product is a mixture of a calcium carbonate powder comprising porous granules which is a shell powder having crystalline structural body of calcite type structure of calcium carbonate and a  
25 calcium oxide powder prepared by calcining the calcium carbonate powder, or an aqueous solution of the mixture.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates an example of a toothbrush according  
30 to the invention.

Fig. 2 illustrates a cross section of a handle of a toothbrush in another example of the invention.

Fig. 3 illustrates a cross section of bristles of the toothbrush in another example of the invention.

## BEST MODE FOR CARRYING OUT THE INVENTION

The invention will be described in detail with reference to embodiments of the invention.

5        In figures, the reference numeral 1 denotes a toothbrush, which comprises a plurality of bristles 3 planted at the tip of a handle 2 made of a synthetic resin material. A bristle-forming synthetic resin material is used for the bristle 3 planted at the tip of the toothbrush1, wherein a product  
10        obtained by pulverizing shells having crystalline structural body of calcite type structure of calcium carbonate is mixed with a synthetic resin material selected for the bristles of the toothbrush.

      The handle 2 is formed using a handle-forming synthetic  
15        resin material obtained in such a manner that a product obtained by pulverizing shells having crystalline structural body of calcite type structure of calcium carbonate is mixed with a synthetic resin material selected for the handle of the toothbrush.

20        Shells mainly comprising at least crystalline structural body of calcite type structure of calcium carbonate are used for obtaining the product mixed into the handle 2 and bristles 3 of the toothbrush 1. This shell is a scallop shell, which is different from other shells in that most part of this shell  
25        has the crystalline structural body. The scallop is characterized in its quick motion for escaping from predators (such as starfishes) in its ecological state, as is expressed as "swim in the sea" by vigorously ejecting sea water out of the shell by opening and closing the shell. The scallop has a  
30        large shell ligament for enabling this motion, while the shell itself is relatively thin and lightweight with a high strength. Crystalline structural body of calcite type structure of calcium carbonate assumes a foliaceous structure to form the inner surface of the shell, while crystalline

structural body of calcite type structure of calcium carbonate assumes a plate-like structure in the inner layer of the shell (the core layer in the direction of thickness of the shell). Since the structures of the inner surface and inner layer of the shell accounts for major part (portions except the surface layer and hinge) of the shell, the shell is strong while it is thin and lightweight.

As described above, crystalline structural body of calcite type structure of calcium carbonate assumes a foliaceous structure (a structure in which needle-like crystals are closely packed and arranged like a kenzann (a needle plate used for flower arrangement)) in the inner surface of the main part of the scallop shell while crystalline structural body of calcite type structure of calcium carbonate assumes a plate-like structure (layers in which needle-like crystals are aligned in the same direction forming a multilayer structure like a plywood, and the directions of the needle-like crystals are different among the layers) in the inner layer of the shell. Therefore, the powder obtained by pulverizing the scallop shells is porous with the calcite type structure remain as described below. On the contrary, calcium carbonate crystals are spread in a plane and piled in other kinds of shells, and the powder prepared from these shells is not porous, although it exhibits pearly luster.

When the scallop shell is used as the raw material of the product of the invention as described above, the shell disposed of as a needless waste after removing the shell ligament may be utilized to enable the waste to be effectively used. In the first step, waste shells are collected and are hardened by drying in the sun. Then, the shells hardened by drying in the sun are pulverized to a particle diameter of about 200  $\mu\text{m}$ . The pulverizing method itself is not particularly restricted, and an existing pulverizer may be

used. The calcium carbonate powder thus obtained comprises porous granules.

A part of the calcium carbonate powder comprising the porous granules is placed in a rotary kiln, and is heated at about 1000°C for several minutes to several hours to obtain a calcium oxide powder. The product of the invention is obtained by mixing the calcium oxide powder and calcium carbonate powder.

The product is mixed with a synthetic resin material selected for the bristles, and the bristles 3 are obtained by forming the resin into filaments. These bristles are planted at a prescribed position of the handle 2. Likewise, the product is mixed with a synthetic resin material selected for the handle, and the handle 2 is obtained by molding the resin material.

The calcium carbonate powder in the product comprises porous granules peculiar to the scallop shell powder as a natural product as described above. Since such product comprises the scallop shell powder as a natural product, it has antibacterial or antifungal properties common to the natural product. Such antibacterial and antifungal properties serve for suppressing proliferation of bacteria and fungi. Since the product is exposed on the surfaces of the handle 2 and bristles 3 of this toothbrush, activity of bacteria and fungi is suppressed by polishing the teeth with the toothbrush 1 due to the antibacterial and antifungal actions of the product common to the natural product. The "natural product" is herein a term opposite to "chemically synthesized products", and the shells of cultured scallop also belong to the natural product.

The calcium oxide powder is alkaline, and also exhibits strong antibacterial and antifungal properties. The calcium oxide powder is converted into calcium hydroxide by the action of water in the oral cavity when the teeth is polished using

the toothbrush of the invention, proliferation of the bacteria and fungi is suppressed, or the bacteria and fungi are killed, by creating an alkaline environment in the oral cavity. Therefore, the toothbrush is quite effective for preventing  
5 tooth decay while sanitary conditions of the toothbrush 1 is maintained after the use.

While the product of the invention is a mixture of the calcium carbonate powder comprising porous granules, which is a shell powder having crystalline structural body of calcite  
10 type structure of calcium carbonate, and calcium oxide powder prepared by calcining the calcium carbonate powder, the product may be an aqueous solution of this mixture. The product may comprise only the calcium carbonate powder or the calcium oxide powder, or an aqueous solution of calcium  
15 carbonate or calcium oxide. The handle comprising more densely distributed antibacterial and antifungal substances on the surface may be formed when the product as an aqueous solution is mixed with the synthetic resin material for the handle, and the handle 2 is molded from this material.  
20 Likewise, the bristle comprising more densely distributed antibacterial and antifungal substances on the surface may be formed when the product as an aqueous solution is mixed with the synthetic resin material for the bristle, and the bristle 3 is molded from this material.

25 While both the handle 2 and bristle 3 are molded from the material in which the product of the invention mixed, any one of the handle 2 and bristle 3 may be molded from the material with which the product of the invention mixed.

Figs. 2 and 3 show another embodiment. In this  
30 embodiment, a coating layer 5 is formed on the surface of a main body 4 of the handle 2 of the toothbrush 1 as shown in Fig. 2, and the coating layer 5 is also formed on the surface of a main body 6 of the bristle 3 as shown in Fig. 3. The coating layer 5 is formed by mixing the product as a powder or

an aqueous solution with the coating material, which is applied on the surfaces of the main body 4 of the handle and the main body 6 of the bristle.

5 Providing the coating layer 5 containing the product on the surface of the handle 2 and bristle 3 permits the toothbrush 1 manifesting a useful effect such as antibacterial and antifungal property to be obtained.

10 The method for forming the coating layer is not restricted to the coating method described above, and other methods such as spraying the coating material and dipping into the coating material may be possible.

15 In this embodiment, the coating layer may be formed by mixing the product of the invention in either the handle 2 or the bristle 3. The materials for the main body 4 of the handle and the main body 6 of the bristle are not restricted.

#### INDUSTRIAL APPLICABILITY

20 According to the invention, an alkaline environment can be readily formed in the oral cavity by polishing the teeth using the toothbrush of the invention, which is effective for preventing tooth decay by suppressing the activity of oral bacteria and fungi. Dissolved calcium components from the product of the invention applied on the toothbrush may contribute to the growth of the teeth. The invention also  
25 exerts a practically excellent effect by enhancing the toothbrush's own antibacterial and antifungal properties to maintain sanitary condition of the toothbrush itself.